

# **ANALYSIS AND MONITORING OF EMERGING ORGANIC POLLUTANTS ADSORBED IN MICROPLASTICS IN WATER BY LIQUID ELECTRON IONISATION MASS SPECTROMETRY (LEI - MS)**

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In the European Union, the issue of water quality is crucial. A growing concern is being expressed in particular about the presence of emerging pollutants in water. Economic, social, and demographic changes worldwide have led to increased water demand. But the appearance of new chemical threats to freshwater resources involving emerging pollutants (EPs) and microplastics (MPs) has become a major problem. Recent studies on water contamination have changed their focus from traditional organic priority pollutants to emerging contaminants from different sources. Microplastics are polymeric particles ranging from 100 nm to < 5 mm in diameter. The most commonly found MPs are polyethylene (PE) and polystyrene (PS) followed by polypropylene (PP), polyvinylchloride (PVC), polyethylene terephthalate (PET), polyamide (PA) and polyvinyl alcohol (PVA). Due to their pervasiveness and potential harm to ecosystems, animals, and public health, microplastics are a major environmental issue. MPs coexist with mixtures of contaminants in the environment and have been reported to act as vectors for the transfer of these chemical contaminants from water and soil to aquatic and terrestrial organisms. This usually occurs due to the sorption of organic pollutants on the hydrophobic surface of the MPs. MPs are capable of adsorbing different types of hydrophobic organic pollutants, such as polycyclic aromatic hydrocarbons (PAHs), hexachlorocyclohexanes (HCHs), polychlorinated benzenes (PCBs), perfluoroalkyl substances (PFASs). The combination of microplastics - emerging pollutants represents a serious environmental problem as they may change the environmental fate, bioavailability, and biomagnification of environmental contaminants.

## **OBJECTIVES AND METHODOLOGY OF THE STUDY**

The project aims to analyse and monitor emerging organic pollutants adsorbed in microplastics in water by liquid electron ionization mass spectrometry (LEI - MS) technique.

- a) to identify and determine the types of microplastics in the water sample.
- b) to identify and determine the concentration of various emerging organic pollutants (EPs) adsorbed in microplastics in the sample.
- c) to identify their possible spatial distributions.
- d) to assess the kinetic of the transfer process.

### **Identification And Characterization of Microplastics :**

*Separation and extraction:* Microplastics are separated using sieves with individual or in series mesh (0.038–4.75 mm) or filters of small mesh sizes (0.02–5 µm).

*Visualization:* A light microscope or the naked eye is used for the identification of larger particles of MPs (1–5 mm).

*Chemical identification:* Raman spectroscopy is a highly reliable mapping technique for the chemical identification of MPs in both solid and liquid samples, but the presence of adsorbed contaminants or additives, color, and fluorescence might interfere with Raman analysis. Fourier transform infrared (FTIR) spectroscopy is a complementary technique for Raman spectroscopy which has been widely used for MP and adsorbed pollutant identification in environmental samples.

### **Analysis of emerging contaminants found in microplastics:**

*Sample Preparation :* The purified microplastic samples are dissolved in an appropriate solvent forming a liquid solution. The solution is introduced to a mass spectrometer for the analysis.

*Liquid Electron Ionization :* Liquid electron ionization (LEI), developed by Prof. Cappiello and his research team is an innovative technique that converts the liquid eluent from the high performance liquid chromatography (HPLC) into the gas phase in the mass spectrometer coupled with electron ionization (EI) ion source. In LEI – MS electron beam is directed into the vaporized liquid sample, resulting in the ionisation of the analyte molecules. Thanks to library searchable mass spectra, LEI allows a correct and rapid identification of the analytes.

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